Claims

1. Apparatus for producing a flux of charge carriers comprising:

a source which comprises an emitter having a nanometre scale tip radius on a common substrate with an extractor arranged no more than 50nm from the emitter to extract charge carriers therefrom and

a specimen adjacent the source, to receive a flux of charge carriers from the source.

2. Apparatus according to claim 1, wherein the emitter has a tip radius less than 2nm.

3. Apparatus according to claim 2, wherein the emitter has a tip radius less than 1nm.

4. Apparatus according to claim 1, wherein the extractor is arranged no more than 30 nm from the emitter.

5. Apparatus according to claim 1, wherein the emitter and extractor are configured such that said charge carriers are extracted while a bias is applied to the extractor relative to the emitter.

6. Apparatus according to claim 5, wherein the relative applied bias is positive.

7. Apparatus according to claim 5, wherein the relative applied bias is between 7 to 20 V.

8. Apparatus according to claim 1 including a bias source to apply a bias to the specimen relative to the emitter.

9. Apparatus according to claim 8, wherein the bias applied by the bias source to the specimen is positive relative to the emitter.

10. Apparatus according to claim 8, wherein the bias applied by the bias source to the specimen is between 14 to 40 V relative to the emitter.

11. Apparatus according to claim 1, wherein the emitter comprises a metal.

12. Apparatus according to claim 11, wherein the metal comprises tungsten.

13. Apparatus according to claim 12, wherein the emitter comprises a tip member.

14. Apparatus according to claim 13, wherein the tip member comprises an alloy of gold and palladium.

15. Apparatus according to claim 13, wherein the tip member has a radius less than 2nm.

16. Apparatus according to claim 1, wherein the extractor comprises tungsten.

17. Apparatus according to claim 1, wherein the extractor comprises a sheet having an aperture.

18. Apparatus according to claim 17, wherein the diameter of the aperture is less than 100nm.

19. Apparatus according to claim 18, wherein the diameter of the aperture is less than 50nm.

20. Apparatus according to claim 1, wherein the source further comprises a collector for collecting charge carriers.

21. Apparatus according claim 1, wherein the source further comprises a deflector for deflecting flux of charge carriers.

22. Apparatus according to claim 1, wherein the source further comprises a lens for focussing the flux of charge carriers.

23. Apparatus according to claim 1, wherein the flux of charge carriers is a charge carrier beam.

24. Apparatus according to claim 1 configured to operate in air at atmospheric pressure.

25. Apparatus according to claim 1, wherein the charge carriers are electrons.

26. Apparatus according to claim 1, wherein the emitter and the specimen are disposed less than 200nm from each other.

27. Apparatus for producing a flux of charge carriers comprising:

a source which comprises an emitter and an extractor to extract charge carriers from the emitter, wherein the emitter and the extractor are configured on a common substrate and

a specimen,

wherein the emitter and the specimen are arranged in a near-field configuration.

28. Apparatus according to claim 27, wherein in the near-field configuration phase coherence of the charge carriers is substantially maintained.

29. Apparatus according to claim 27, wherein the near-field configuration comprises an arrangement whereby the emitter and the specimen are disposed less than 200nm from each other.

30. Apparatus according to claim 27, wherein the extractor is arranged no more than 50 nm from the emitter.

31. Apparatus according to claim 27, wherein the extractor is arranged no more than 30 nm from the emitter.

32. Apparatus for producing a flux of charge carriers comprising:
a source which comprises:
an emitter and
an extractor to extract charge carriers from the emitter,
wherein the emitter and the extractor are configured so as to allow extraction of charge carriers under a gaseous atmosphere without ionisation of the gas and
a specimen adjacent the source, to receive a flux of charge carriers from the source.

33. Apparatus according to claim 32, wherein the emitter and extractor are configured such that said charge carriers are extracted while a bias is applied to the extractor relative to the emitter.

34. Apparatus according to claim 33, wherein the relative applied bias is positive.

35. Apparatus according to claim 34, wherein the relative applied bias is between 7 to 20 V.

36. Apparatus for producing a flux of charge carriers comprising:
a source which comprises:
an emitter and
an extractor to extract charge carriers from the emitter and configured to extract charge carriers while a turn-on bias of less than 100V is applied to the extractor relative to the emitter and
a specimen adjacent the source, to receive a flux of charge carriers from the source.

37. Apparatus according to claim 36, wherein the turn-on bias is less than 10V.

38. A method of producing a flux of charge carriers, the method comprising:
providing a source comprising configuring an emitter having a nanometre scale tip radius on a substrate with an extractor arranged no more than 50nm from the emitter to extract charge carriers therefrom and

providing a specimen adjacent the source, to receive a flux of charge carriers from the source.

39. A method of fabricating a source for apparatus for producing a flux of charge carriers, the method comprising depositing a thin film and allowing said thin film to coalesce into individual particles.